DRAFT

SPACE ENVIRONMENT MONITOR

(SEM)

INTERFACE REQUIREMENTS

FOR

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE

(GOES – R)

PAYLOAD ACCOMMODATION STUDY

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PREPARED FOR

GODDARD SPACE FLIGHT CENTER

NATIONAL AERONAUTIC AND SPACE ADMINISTRATION

SPACE ENVIRONMENT MONITOR
INTERFACE REQUIREMENTS for GOES-R PAYLOAD ACCOMMODATION STUDY

1. Magnetometer

1.1 Performance Requirement:
The spacecraft contractor shall provide redundant, simultaneous, accurate tri-axial measurements of the Earth ambient magnetic field vector. Overall accuracy in the spacecraft frame of reference to be 1 nanoTesla per axis.

1.2 Probable Interface Impacts:

1.2.1 Mass (per instrument): 1 kg electronics; 0.4 kg sensor

1.2.2 Power (per instrument): 1 watt
1.2.3 Telemetry (per instrument): 100 bps

1.2.4 Instrument Accommodation: a non-magnetic boom system long enough when deployed to remove the instruments from uncorrectable spacecraft magnetic fields and geometrically stable to approximately 0.25 degrees of arc.

1.2.5 Command (per instrument):
Pulse Commands: 2 (Power On/Power Off)
Serial Data Command: 1 (Instrument Mode Control)

1.2.6 Envelope (per instrument):
Electronics: (17.6 cm X 19 cm) X 8 cm
Sensor: (7.2 cm X 7.2 cm) X 9.5 cm

2. XRS/EUV

2.1 Performance Requirement:

The spacecraft contractor shall provide radiometer(s) to monitor total solar flux in two (2) x-ray wavelength bands and five (5) wavelength bands in the extreme ultraviolet.

2.2 Probable Interface Impacts:

2.2.1 Mass: 9 kg

2.2.2 Power: 7 watts

2.2.3 Telemetry: 32 bps

2.2.4 Instrument Accommodation: The spacecraft must provide a sun pointing platform with clear field-of-view, pointing accuracy, and jitter characteristics appropriate for the XRS/EUV instrument. The instrument response, including the combined effect of spacecraft pointing and sensor field-of-view, shall not deviate by more than 5% (goal 2%) for point sources of constant flux within +/- 20 arc-minutes of the solar disk center. The absolute accuracy of the telemetered X-ray flux data shall be demonstrated by analysis and/or test to be better than +/- 20% of reading (goal 10%) for flux values greater than 20 times threshold.

2.2.5 Command:
Pulse Command: 4 (Power On/Power Off, Start/Terminate IFC)

2.2.6 Envelope:
34cm X 22 cm X 22 cm (packaged as one assembly)

3. Energetic Particle Detectors

3.1 Performance Requirement:

The spacecraft contractor shall provide a suite of energetic particle detectors to monitor electron, proton, and ion *in-situ* particle flux over a wide range of energies. Geometric resolution shall be appropriate to the degree of anisotropy in the environment as a function of energy band. For lower energy ranges associated with geomagnetically trapped particles, orthogonal fan-shaped clear fields-of-view of 30 degrees of arc by 180 degrees of arc centered on the zenith are required.

3.2 Probable Interface Impacts:

3.2.1 Mass: 32 kg

3.2.2 Power: 70 watts

3.2.3 Telemetry: 150 bps

3.2.4 Instrument Accommodation: The particle types and ranges of spectral and geometric resolution required most likely lead to a central processing unit servicing a suite of sensor assemblies requiring independent locations on the spacecraft body, and having distinct clear fields of view appropriate to the acceptance aperture in each detector channel. Assuming the magnetosperically trapped electron and proton detectors are packaged as independent assemblies, those assemblies will require the large clear field-of-view described in 3.1, and the instrument must also provide relatively high geometric resolution within that field-of-view. Intermediate energy range electron, proton and alpha particle channels will require at least two look angles, each with an acceptance aperture of at least +/-30 degrees in azimuth and +/-30 degrees in elevation. If two look angles are used, it is desirable that they one be oriented eastward and one westward. The spacecraft must provide a clear field-of-view over

whatever acceptance aperture is realized by the instrument design. The highest energies to be monitored are protons >350 MeV (al least 4 channels) and alpha particles >640MeV/nucleon (at least 2 channels). Detector(s) for these channels shall have acceptance aperture(s) > 24 degrees half angle. The apertures shall be centered within 5 degrees of the equatorial plane and within 100 degrees of the local zenith.

3.2.5 Command:
Pulse Command: 6
Serial Command: 1 (24 bits or more)

It is assumed that because of the large number of detector assemblies and data channels required, a certain amount of redundancy and modal flexibility will be required and provided. The listed commands are considered the minimum required to operate the instrument.

3.2.6 Envelope:
Central Processing Unit: (22 cm X 22 cm) X 13 cm
Magnetospheric proton detector: (26.5 cm X 34 cm) X 29.5 cm
Magnetospheric electron detector: (26.5 cm X 34 cm) X 29.5 cm
Intermediate energy range detectors: 17 cm X 29 cm (each look angle)
High energy proton and alpha particle detector: (17 X 28) X 14.5 cm